CONCRETE RECEPTACLE ASSEMBLY AND METHOD FOR USING THE SAME TO CREATE SYNTHETIC RIPRAP BLOCKS

CROSS REFERENCE TO RELATED APPLICATION

The present application claims benefit of Provisional Patent Application No. 60/454,938, filed on March 14, 2003.

FIELD OF THE INVENTION

[0001] The present invention generally relates to the field of concrete reclamation, and more particularly, the present invention relates to a concrete receptacle assembly that facilitates the disposal of concrete waste and recycling said concrete waste for use as riprap.

BACKGROUND OF THE INVENTION

[0002] The concrete industry wastes significant amounts of concrete each year. Concrete batch plants tend to waste on average one yard of concrete per day for each truck used to transport the concrete. While there are multiple reasons concerning why waste concrete is produced, one substantial reason is that contractors and persons in the construction industry order too much concrete for a particular job. As a result, the disposal of the unused, waste concrete is a major concern for the construction industry as well as for environmentalists.

[0003] Historically, several methods have been used for controlling the excess concrete produced at any particular work site. The most commonly used means for controlling waste concrete is a traditional washing out of the concrete mixer into a slurry. The benefit of such a system is that slurries commonly preexist at many work sites. Furthermore, the use of a slurry is easy for laborers due to the low maintenance requirements and the simple technological

requirements. However, this system produces a cementitious slurry at the work site that is also expensive for disposal, not considering the extraordinary length of time that it takes to dispose of the slurry. In addition, this system requires an extensive yard space for the location of the slurry. A related means for disposing of waste concrete is a chemical wash out of the waste concrete from a mixer. However, such a method requires a significant initial capital investment as well as high ongoing costs.

[0004] Another method for the disposal of waste concrete is referred to as "stoning out", wherein the hardened concrete is pulverized and distributed at a desired location. While this requires little capital costs, it does require ground storage and the pulverized concrete may not be suitable for use after multiple mixes.

[0005] One final method for reusing concrete is to employ a reclaimer, which will maintain the concrete in a somewhat fluid form for later use. While this allows for use of all materials, it has high capital costs and high maintenance costs. Moreover, it requires constant supervision and a consistently high production plant to work efficiently.

SUMMARY OF THE INVENTION

[0006] The present invention provides a concrete receptacle assembly that is used to receive waste concrete and mold the waste concrete into synthetic riprap. Specifically, the concrete receptacle assembly includes a frame surrounding a series of cells used to receive waste concrete from construction worksites and related areas. The concrete receptacle assembly is then arranged in such a way so that it may be turned over without interference from nearby obstructions. Once the cells of the concrete receptacle assembly are filled, the excess concrete is then leveled off of the top using a screed and the top layer is patted to provide a smooth surface.

[0007] The concrete is then allowed to cure in the cells of the concrete receptacle assembly for a predetermined amount of time corresponding to the size of the cells and the depth of the concrete. Once cured, the concrete receptacle assembly is upended such that the concrete riprap blocks will be dispelled when the concrete receptacle assembly makes contact with the ground. Once the synthetic riprap blocks have been extracted, the concrete receptacle assembly is prepped for the next cycle of production.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] A concrete receptacle assembly embodying the features of the present invention is depicted in the accompanying drawings which form a portion of this disclosure, wherein:

[0009] Figure 1 is a perspective view of the concrete receptacle assembly of the present invention;

[0010] Figure 2 is a top plan view of the concrete receptacle assembly of the present invention;

[0011] Figure 3 is a bottom view of the concrete receptacle assembly of the present invention;

[0012] Figure 4 is a front elevational view of the concrete receptacle assembly of the present invention taken along lines 4--4 of Figure 1;

[0013] Figure 5 is a rear elevational view of the concrete receptacle assembly of the present invention taken along lines 5--5 of Figure 1;

[0014] Figure 6 is a first side elevational view of the concrete receptacle assembly of the present invention taken along lines 6--6 of Figure 2;

[0015] Figure 7 is a second side elevational view of the concrete receptacle assembly of the present invention taken along lines 7--7 of Figure 2;

[0016] Figure 8 is a perspective view of an upended embodiment of the concrete receptacle assembly, with a vehicle for upending the concrete receptacle assembly proximate the concrete receptacle assembly;

[0017] Figure 9 is a side elevational view of one cell from the concrete receptacle assembly, said view illustrating the various angles of the tapered edges of said cell;

[0018] Figure 10a is a sectional view of the concrete receptacle assembly taken along the lines 10a--10a of Figure 2;

[0019] Figure 10b is a sectional view of the concrete receptacle assembly taken along the lines of 10b--10b of Figure 2; and

[0020] Figure 11 is a side elevational view of one embodiment of the concrete receptacle assembly having a railing.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0021] Referring to the figures for a better understanding of present invention, it will be appreciated that the present invention comprises a concrete receptacle assembly **10** that is transportable to a location having waste concrete (not illustrated), such as a construction work site, a cement plant, or other concrete facility, to receive excess waste concrete which is otherwise not useful and must be disposed of by the user. In particular, the concrete receptacle assembly **10**, as illustrated in Figures 1-7, forms the waste concrete into synthetic, formed riprap blocks **14** (as illustrated in Figure 1b) that may be used for a variety of purposes. For example, the synthetic riprap blocks **14** may be used for pier and abutment protection at new and existing

bridges, for inlet and outlet protection at new and existing culverts, for river and creek stream training, for spillways, for general erosion control, and numerous other related applications.

[0022] The concrete receptacle assembly **10** of the present invention includes an outer frame **16** or wall made of a steel plate or multiple steel plates that are welded together. While steel plates are used in one embodiment of the invention, it should be noted that other embodiments of the invention may include an outer frame **16** made of sheet metal, cast metal, plastics, or a related material having the strength and durability required to hold the waste concrete and eject the riprap blocks **14** efficiently.

[0023] In the embodiment illustrated in Figure 1, the outer frame **16** has a rectangular shape with two horizontal walls **18** that are connected to two vertical walls **20**. A variety of inner partitions **22, 24** (such as plates or walls) are further connected together and to the inner surface of the surrounding outer frame **16**. Looking to Figure 1, one or more vertical partitions **22** are connected between the horizontal walls **18** and one or more horizontal partitions **24** are connected between the verticals walls **20** to form synthetic riprap cells **26**. In the embodiment shown in Figures 2, 10a and 10b, there are three pairs of vertical partitions **22**, with each vertical partition **22** of each pair sloping towards each other. Likewise, there are three pairs of horizontal partitions **24**, with each horizontal partition **22** of the pair sloping toward each other. Finally, a set of base plates **25** are connected between the vertical partitions **22** of each pair and the horizontal partitions **24** of each pair to provide a bottom surface for the cell **26**. Thus, each cell **26** will have an open side to receive waste concrete and a closed base **25** to contain the waste concrete. As a result, the frame **16** of the concrete receptacle assembly **10** supports the various cells **26** that will receive and hold the waste concrete.

[0024] It should be noted that while the frame **16** of the embodiment illustrated in Figures 1-7 is rectangular, any number of geometrical shapes could be incorporated into the present design to achieve the shape of the cells **26** (and thus the synthetic riprap blocks **14**) as desired by the user. Additionally, the cells **26** generally have a trapezoidal or rectangular cross-section, with tapered sides that ease the extraction of the synthetic riprap blocks **14** from the concrete receptacle assembly **10**, as discussed herein. Synthetic riprap blocks **14** are designed to have specific weight and size dimensions according to specifications as desired by the users of conventional riprap and as set by various governing authorities, such as the Department of Transportation and the Federal Highway Administration. Thus, the concrete receptacle assemblies **10** will vary in size, and will be used daily for stockpiling the synthetic riprap **14** in size and shape as desired by the user. Furthermore, it should be noted that the shape of the cells **26** may be adjusted to create synthetic riprap blocks **14** of different shapes, such as cylindrical blocks or triangular blocks.

[0025] Moreover, the concrete receptacle assemblies **10** may have any number of rows and columns of cells **26**. For example, the embodiment illustrated in Figure 1 includes three cells **26** in each row by three cells **26** in each column. However, any number of other designs, with a variety of cell components, may be provided. For example, the concrete receptacle assembly **10** may include three cells **26** in a row by twelve cells **26** in a column, six cells **26** in a row by six cells **26** in a column, or five cells **26** in a row by two cells **26** in a column. The number of cells **26** is determined according to the desired size of the synthetic riprap blocks **14** and the available room for operation of the concrete receptacle assembly **10** at the construction work site or batch plant. That is, the larger the desired riprap blocks **14**, the fewer cells **26** in each concrete receptacle assembly **10**. Furthermore, it is foreseen that individual concrete receptacle

assemblies **10** may be connected to each other to create the desired number of cells **26** to receive waste concrete. As shown in Figure 8, three concrete receptacle assemblies **10** are welded together, with a clasp **35** (discussed further herein) being connected to adjacent sides of concrete receptacle assemblies **10** to reinforce the connection.

[0026] Looking to Figure 11, the horizontal side walls **18** may be extended above the top surface of the concrete receptacle assembly **10** to form a railing **30**. The railing **30** will prevent any undesired run over of waste concrete from the concrete receptacle assembly **10**, and will keep the concrete in the desired cells **26**.

[0027] As stated above, the present invention is used to create synthetic riprap **14** from the waste concrete and cement that is commonly found at concrete batch plants, cement plants, pipe plants, and other concrete facilities. The process of recycling waste concrete as synthetic riprap blocks **14** involves the step of initially placing the concrete receptacle assembly **10** (or multiple assemblies) on a substantially hard surface. If multiple concrete receptacle assemblies **10** are used, they are lined up side by side.

[0028] Once arranged, a lubricating substance (not illustrated) is then dispersed onto each cell **26** of the concrete receptacle assembly **10** to prepare the cell **26** to receive the waste concrete. The lubricating substance can be any type known in the art, such as form oil or hydraulic oil, although it is desired that the lubricant be environmentally safe. The waste concrete is then poured into one or more cells **26** of each concrete receptacle assembly **10**. Each independent cell **26** is substantially filled before proceeding to fill adjacent cells **26**, such that the amount of waste concrete and cement determines the number of cells **26** that are filled. The railing **30** directs the waste concrete to flow into the next cell **26** or adjacent concrete receptacle assembly **10** once the current cell **26** or current concrete receptacle assembly **10** has been filled,

thereby helping to prevent the undesired spilling of waste concrete from the concrete receptacle assembly **10**.

[0029] The concrete receptacle assemblies **10** are then stored or set for a period of time, with the waste concrete stored therewith in the cells **26**. During this time, the waste concrete will cure into the synthetic riprap blocks **14** desired by the user. While the time required for curing will vary according to the size and shape of the cells **26**, it has been found that a curing time of eight to twelve hours will be sufficient to allow the waste cement to harden into synthetic riprap blocks **14**.

[0030] Once the synthetic riprap blocks **14** have cured, the concrete receptacle assembly **10** is ready to be flipped or inverted to dislodge the synthetic riprap blocks **14** from the concrete receptacle assembly **10**. In one embodiment of the invention, a chain, or a hook connected to a chain (not illustrated) may be attached to a front-end loader **38**, tractor, bulldozer or other piece of machinery, which can then be connected to a bracket **34**, clasp **35**, handle, or other attachment means connected to the concrete receptacle assembly **10**. In one embodiment, the hook is attached to the bucket of the front-end loader **38** using a chain, and the user is able to engage the clasp **35** with the hook. Upward movement of the bucket will then lift the concrete receptacle assembly **10** by the clasp **35** to pick-up or roll concrete receptacle assembly **10** to an inverted position (see Figure 8). In addition, the chain may be connected directly to the concrete receptacle assembly **10** to cause this movement, and the bucket of the front-end loader **38** may directly engage the concrete receptacle assembly **10** to upend the concrete receptacle assembly **10**.

[0031] Once the concrete receptacle assemblies **10** are rolled, the synthetic riprap **14** will fall out from the concrete receptacle assembly **10**, either when the top side of the concrete receptacle

assembly **10** strikes the ground surface or prior to that force. The synthetic riprap blocks **14** are then pushed into a pile and the concrete receptacle assembly **10** is oiled once again and made ready for the next cycle of production. The lubricating substance dispersed in the cells **26** will aid in unloading of the synthetic riprap **14**. The user will then be able to push the synthetic riprap **14** into a pile for transport to the desired location.

[0032] The present invention was tested at a concrete plant where three concrete receptacle assemblies **10** were utilized. The concrete receptacle assemblies **10** were filled with the waste concrete. Two concrete receptacle assemblies **10** were filled without screeding the top excess layer of waste concrete, and the other was filled just to the top of the cell **26**. The next morning the concrete receptacle assemblies **10** were rolled and, while the synthetic riprap blocks **14** were green in appearance, the concrete synthetic riprap blocks **14** were nonetheless extracted. The concrete receptacle assembly **10** having the least amount of excess waste concrete in the cell **26** appeared to produce riprap blocks **14** with the desired structure that were dislodged with minor effort. The other two concrete receptacle assemblies **10** were filled to the point where concrete spilled across the edges, thereby combining each cell **26**. After rolling the concrete receptacle assemblies **10**, it was determined that the bond between cells **26** in the embodiment that was overfilled limited the smooth extraction of the riprap blocks **14** from the concrete receptacle assemblies **10**. This led to the inclusion of a small hole **32** or aperture through the base plate **25** of each cell **26**. This hole **32** makes extraction of the synthetic riprap blocks **14** easier, especially when the synthetic riprap blocks **14** are uncured and greenish in color.

[0033] It should be noted that testing found that certain synthetic riprap blocks **14** required more effort to dislodge the blocks **14** from the concrete receptacle assembly **10**. In particular, it was found that the friction from the two flat sides on each side of the synthetic riprap block **14**

prevented the riprap blocks **14** from being extracted easily, and required a substantial amount of bouncing and shaking of the concrete receptacle assemblies **10** to dislodge the riprap blocks **14**. Consequently, this test led to a design wherein all of the sides of a cell **26** (that is, the horizontal partitions **24** and the vertical partitions **22**) are tapered. By tapering the partitions **22**, **24**, the riprap blocks **14** were more easily dislocated.

[0034] The concrete receptacle assembly **10** addresses a number of problems in both the concrete industry and in the construction industry. For example, quarries that conventionally supply riprap are located in geographical areas corresponding to the presence of required rocks and minerals. In many instances, the quarries where riprap is extracted are distant from the locations where the riprap is needed. Consequently, significant costs are required for hauling the riprap erosion control to the distant sites. The present invention is able to produce synthetic riprap blocks **14** locally rather than at a distant location.

[0035] The concrete receptacle assembly **10** is simple to use, but has a complex system of elements that provides the ease of extraction of the riprap blocks **14**. Specifically, each cell **26** of a concrete receptacle assembly **10** includes four tapered sides per unit; a small aperture **32** in the bottom of each cell **26** to prevent a suction of the riprap **14** to the cell **26**; an extension is in place for allowing concrete to spill from one form to the next when lined up; and form oil is used to protect the concrete receptacle assembly **10** and to provide ease of extraction of the riprap block **14**.

[0036] Referring to Figure 10, a sectional side view of one cell **26** is illustrated, with the various potential angles of the vertical partitions **22** being shown. The vertical partitions **22** may be between 0 degrees to 60 degrees from the horizontal plane **22a**, depending on the desired shape of the riprap block **14** for the desired use of the riprap block **14**. For example, for cells **26**

having vertical partitions **22** close to 0 degrees from the vertical plane **22a**, the shape of the synthetic riprap **14** will be substantially rectangular. This will provide a steep angle of repose for each of the sides of the synthetic riprap **14**, which allows for steeper piles when stockpiling the riprap **14** and less room to be taken up by storage of the riprap blocks **14** and for steeper placement of the riprap blocks **14** when used for erosion control. Like the vertical partitions **22**, the horizontal partitions **24** may be tapered as desired by the user.

[0037] It should be noted that the completed synthetic riprap blocks **14** do not have to be hand-placed on the ground surface by a worker. Rather, the riprap blocks **14** have a sturdy production from the waste cement such that they can be dumped onto the ground surface and handled like conventional riprap used in the construction industry.

[0038] Through the use of waste concrete, the present invention provides a continuous, local supply of synthetic riprap **14** that can be produced as long as a concrete plant is in operation. Furthermore, the waste concrete is recycled and reused to create synthetic riprap to take the place or supplement the use of conventional riprap, the most commonly used product for erosion control. This will provide a lower cost to cities, counties, federal and departments of transportation or other organizations. Less waste concrete will provide a service to the community to prevent filling of public landfills and pollution to the environment. That is, currently the waste material will build up into large mounds of poorly graded sediment. However, the use of the present invention will reduce the wastewater that is associated with the concrete waste product, further aiding in the National Pollution Discharge Elimination System (NPDES) required by the Environmental Protection Agency (EPA)

[0039] Thus, although there have been described particular embodiments of the present invention of a new and useful CONCRETE RECEPTACLE ASSEMBLY AND METHOD FOR

USING THE SAME, it is not intended that such references be construed as limitations upon the scope of this invention except as set forth in the following claims.